

NOTE

Two New Records of Pimpline Ichneumonids Attacking *Battus philenor*  
(Linnaeus) (Lepidoptera: Papilionidae)

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A series of seven ichneumonids rediscovered in the American Museum of Natural History collection offers two new host associations. All seven parasitoids were reared from pupae of *Battus philenor* (Linnaeus); one of the specimens is *Theronia atalantae* (Poda), and the other six are *Apechthis annulicornis* (Cresson). The host pupae were all collected on October 3, 1960, at a single site ("North Carolina: above Crabtree to Betsey's Gap; 3956'; Haywood Co.; coll. Gertsch, Ivie"), and the wasps emerged in November 1960. The pupal remains were kept with the wasps, permitting confirmation of the hosts' identity.

These associations are particularly interesting because *Battus philenor* is considered relatively immune to attack by parasitoids. It may be protected by toxins acquired from its food plants, which are the various North American species of *Aristolochia* (Aristolochiaceae). The adults have long been recognized as the unpalatable models for a Batesian mimicry ring (Brower 1958); like many other species in the tribe Troidini (Nishida 1995), *B. philenor* sequesters substantial quantities of aristolochic acids to the adult stage (Sime, in prep.). Experimental evidence indicates that these compounds are unusually toxic, at least to non-adapted lepidopteran larvae (e.g. Miller and Feeny 1989). Haase (1893) was the first to link Aristolochiaceae-feeding with low parasitism rates, observing that *B. philenor* pupae never

yielded parasitoids while the pupae of the palatable mimics *Papilio troilus* Linnaeus and *P. glaucus* Linnaeus frequently produced ichneumonids.

Immature *B. philenor* are commonly collected and studied, and the considerable rearing data available in collections and in both published and unpublished studies suggest that larval and larval-pupal parasitoids are nearly nonexistent and pupal parasitoids rather rare. Among reports in the literature involving larvae, there is just a single record, lacking ecological data, for the tachinid *Compsilura concinnata* (Meigen) (Schaffner and Griswold 1934), which when in butterflies is a larval-pupal parasitoid (Ford and Shaw 1991). I have reared some 90 *B. philenor* (found as larvae) from the Blue Ridge Mountains of Virginia (a habitat similar to that for the new records), but obtained only butterflies. Rausher (1981), in an exhaustive study of *B. philenor* ecology in Texas, noted that in four field seasons no parasitoids emerged from several hundred field-collected larvae reared to adulthood. Other authors have collected pupae: West and Hazel (1982) reported no parasitoids in a Virginia study, though Sims and Shapiro (1983) found that *Brachymeria ovata* (Say) (Chalcididae) occasionally inflicts high mortality in some California populations of *B. philenor*. *Gambrus amoenus* (Gravenhorst) (= *muncius* (Say)) (Ichneumonidae) has reportedly been reared from *B. philenor*, but the genus is thought only to attack

cocooned hosts, and Townes and Townes (1962) and Gupta (1983) consider this species a specialist on *Callosamia* and a few other Saturniidae.

*Theronia atalantae* is common and widespread; it is a polyphagous parasitoid of pupae apparently capable of both primary and secondary parasitism, though almost invariably found to be a secondary parasitoid when possible to investigate (Townes 1940). Almost always associated with Lepidoptera, it has been reared from at least 16 families, most frequently Lymantriidae and Lasiocampidae. (The apparent bias towards these two families may be an artifact of the attention that pests such as gypsy moth and forest tent caterpillars have received.) Whether the new record represents primary or secondary parasitism (perhaps on *A. annulicornis*) is not known. As a secondary parasitoid, however, its presence in *B. philenor* would not necessarily be remarkable: if the primary parasitoid detoxifies plant poisons in the lepidopteran pupa, it might itself become a non-toxic host for *T. atalantae*.

*Apechthis annulicornis* is a pupal parasitoid of Lepidoptera; it is reared less often than is *T. atalantae*, but a number of reports indicate that it has a broad host range, attacking *Neophasia menapia* (Felder & Felder) (Pieridae) and various species of *Choristoneura* (Tortricidae) and *Orgyia* (Lymantriidae) (Carlson 1979 and refs. therein). This record, together with those of *B. ovata* and *C. concinnata* (each of which attacks many families and over 100 species of Lepidoptera (Arnaud 1978; Halstead 1988)), indicates that *B. philenor* is the occasional host of several relatively polyphagous parasitoids that are reared much more often from other, less toxic Lepidoptera. This phenomenon may reflect a broad constitutive tolerance of plant allelochemicals on the part of the generalists: that larval and larval-pupal hymenopteran parasitoids are, in contrast, entirely lacking suggests that the unusual toxicity of aristolochic acids has prevented the

evolution of specialist, koinobiont parasitoids of *B. philenor*.

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